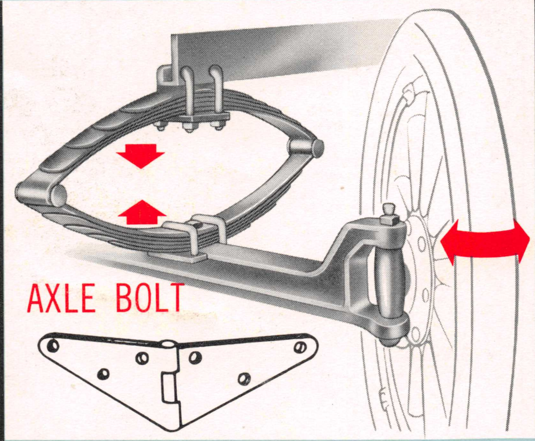
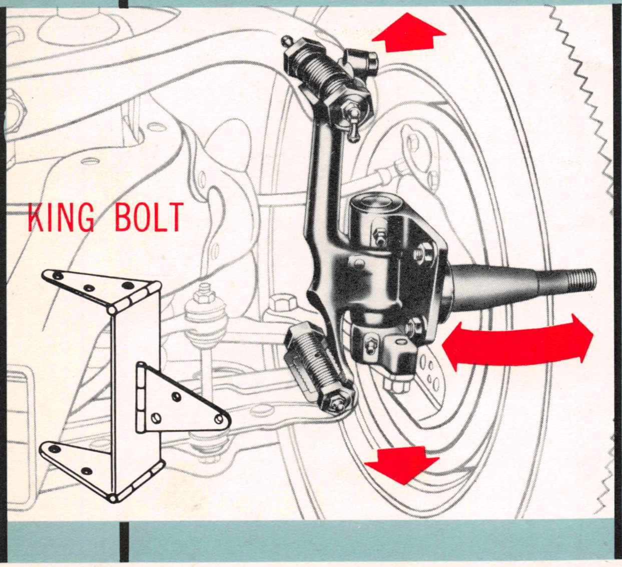
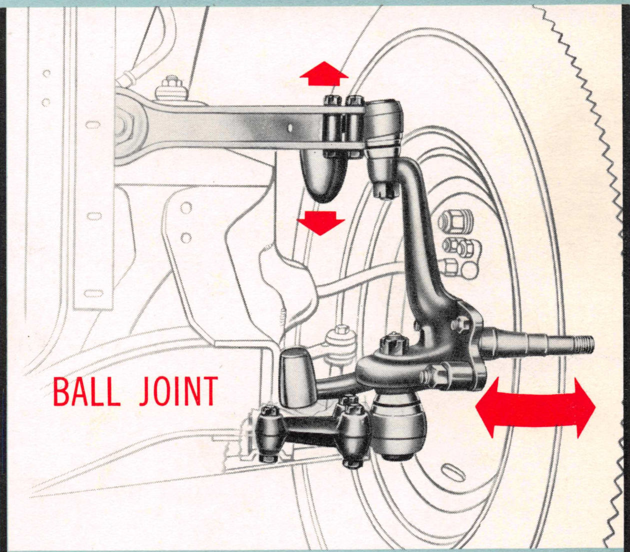
Hinges of Progress

...an era of development

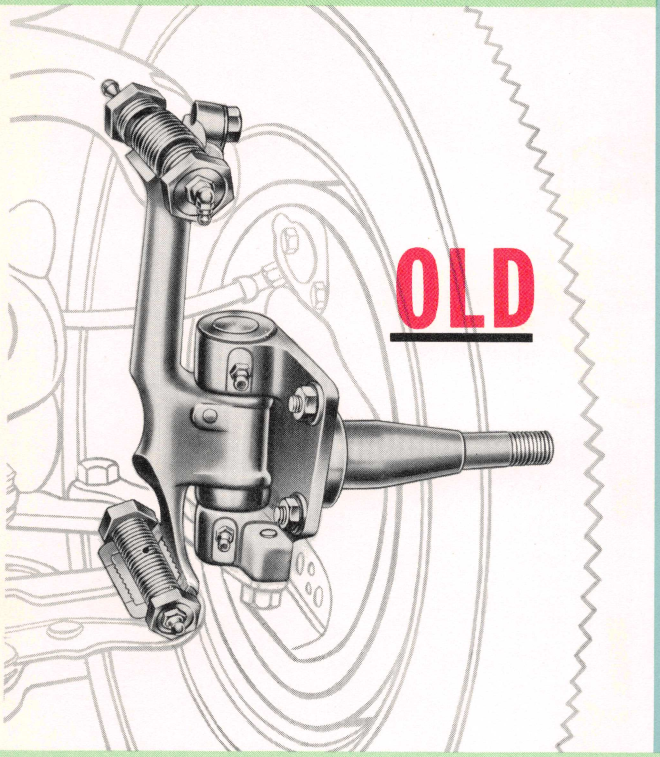

AXLE BOLT


KING BOLT

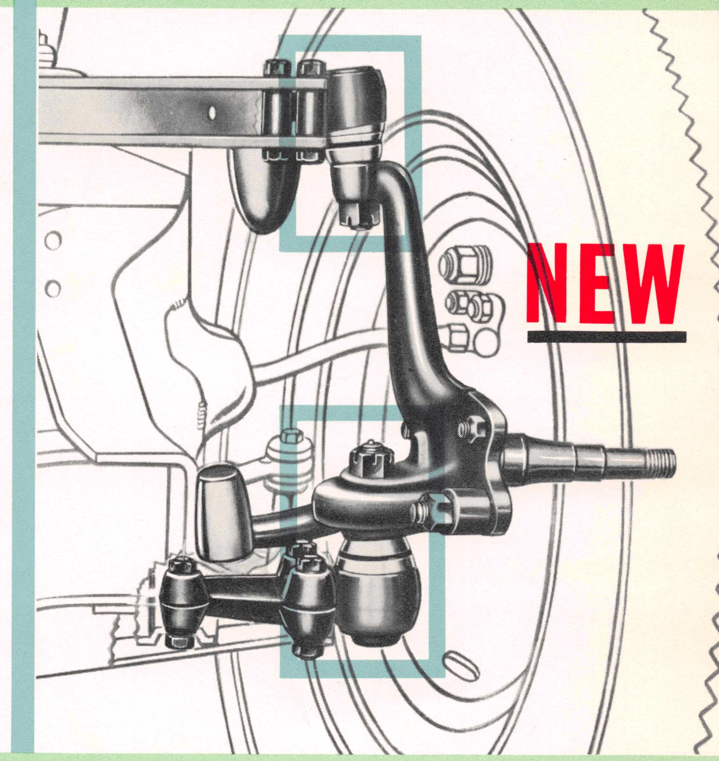

BALL JOINT

TOLEDO STEEL PRODUCTS
Division of Thompson Ramo Wooldridge Inc.
CLEVELAND 31, OHIO

Knuckle & King Pin Assembly



Ball Joint-Spindle Assembly



In 1952, the first American car was equipped with Ball Joint front suspension supplied by our Michigan Division. The Ball Joints presented no particular service problems and were readily accepted by the repair trade. These original Ball Joints were spring pre-loaded, regardless of whether they were upper or lower joints.

In 1955, the air of acceptance and contentment with Ball Joints was reduced, principally because, in that year, a leading vehicle manufacturer introduced non-loaded "loose" type lower Ball Joints on its car. Confusion increased when, in 1957, two other vehicle manufacturers adopted the lower "loose" type Ball Joints. It was no longer possible to check for wear in the front suspension system or in the front wheel bearings by grasping the tire top and bottom and trying to shake it. All of the front end specialists' thoughts and conceptions on how to check a front suspension for wear had to be changed.

The Ball Joint is really a sophisticated scaled-up tie rod end. In a Ball Joint equipped front suspension system, the king bolt assembly, knuckle support pin assemblies and knuckle support are eliminated. The Ball Joints provide both the turning motion of the king bolt and the vertical motion allowed by the knuckle support pins.

With the ball joint system, three pieces replace nine, thus reducing wear points, providing easier steering, better handling characteristics, more room in the engine compartment and therefore lower hood lines—resulting in better driver visibility and increased safety.

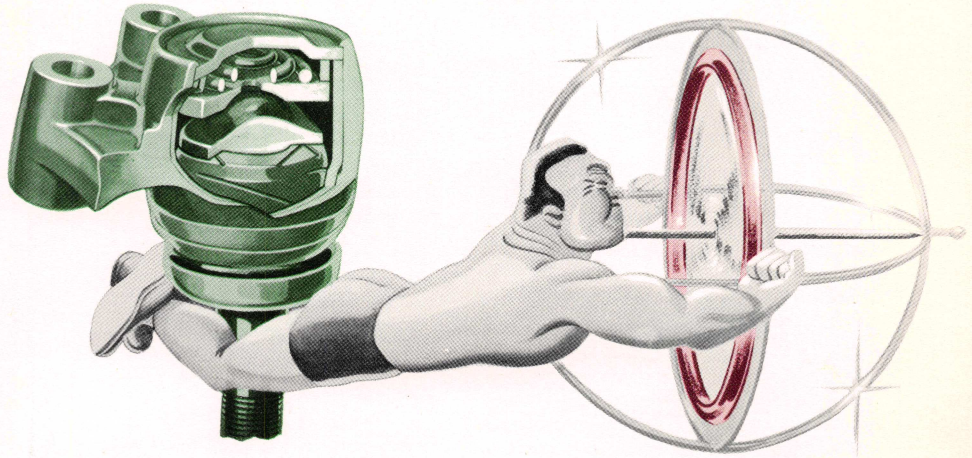
The BALL-JOINT Principle

Our original equipment designs as introduced on Lincoln in 1952

The upper and lower ball joints do not perform the same function.

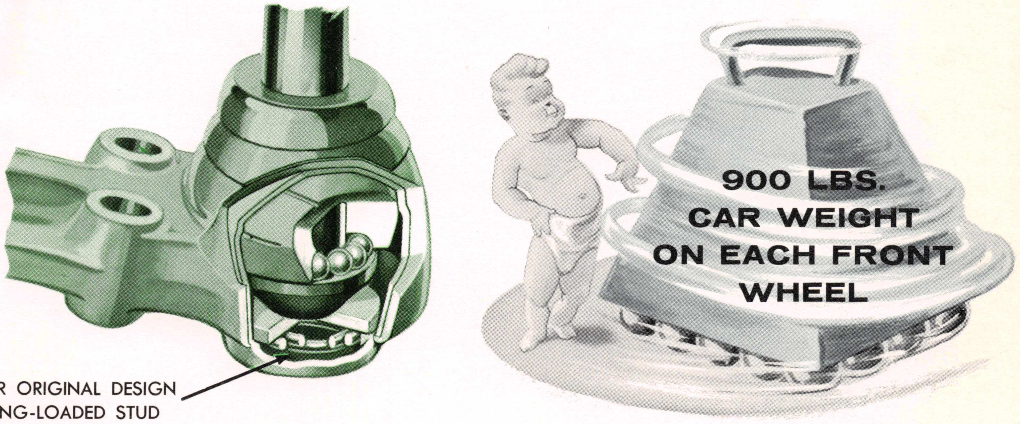
DAMPENING BALL JOINT

One ball joint (usually the upper) is designed to dampen out some of the gyroscopic action of the wheel. It also holds one end of the spindle in position. *The dampening joint is always pre-loaded.*



WEIGHT CARRYING BALL JOINT

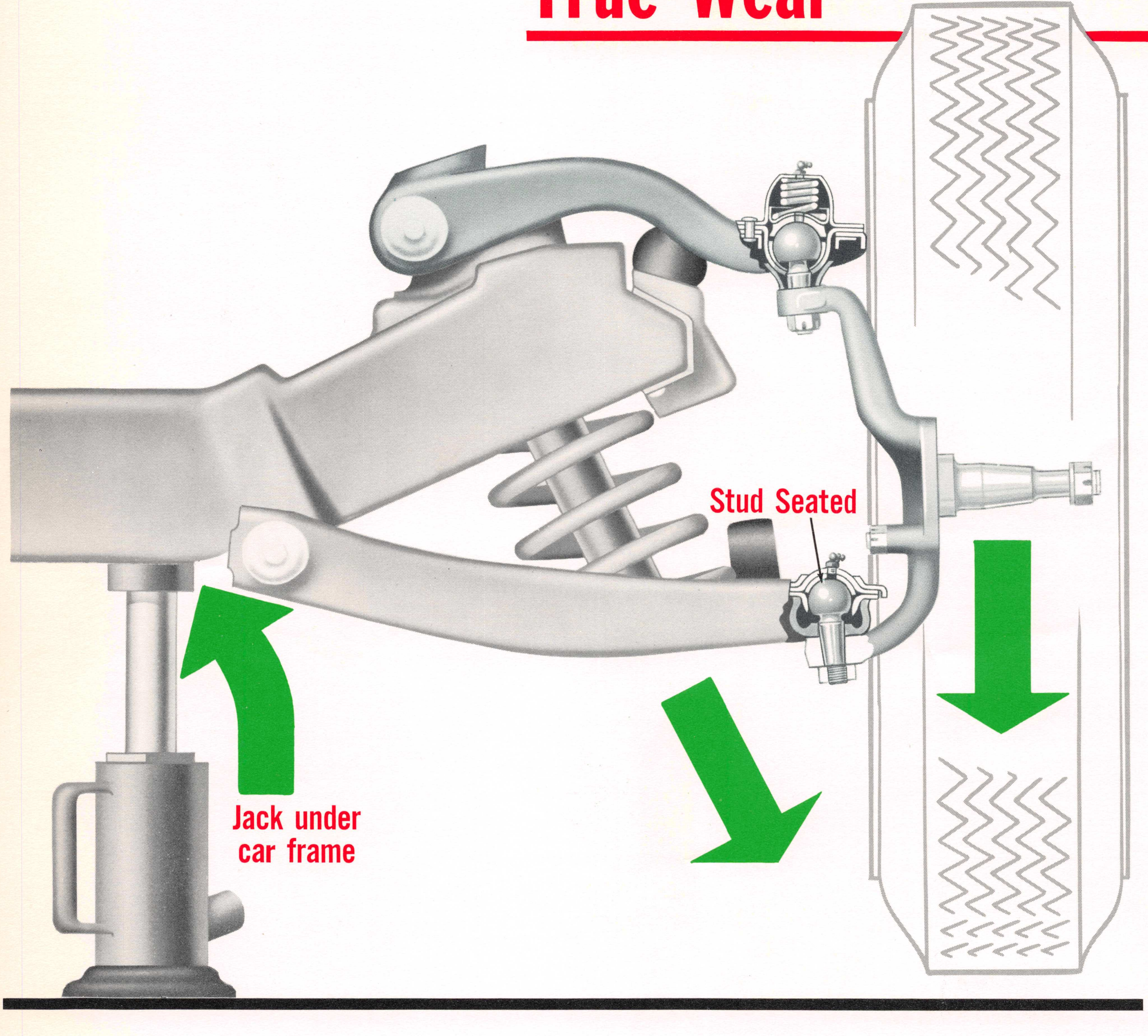
The principal function of the other ball joint (usually the lower) is to carry the weight of the vehicle.



NOTE: OUR ORIGINAL DESIGN HAD SPRING-LOADED STUD

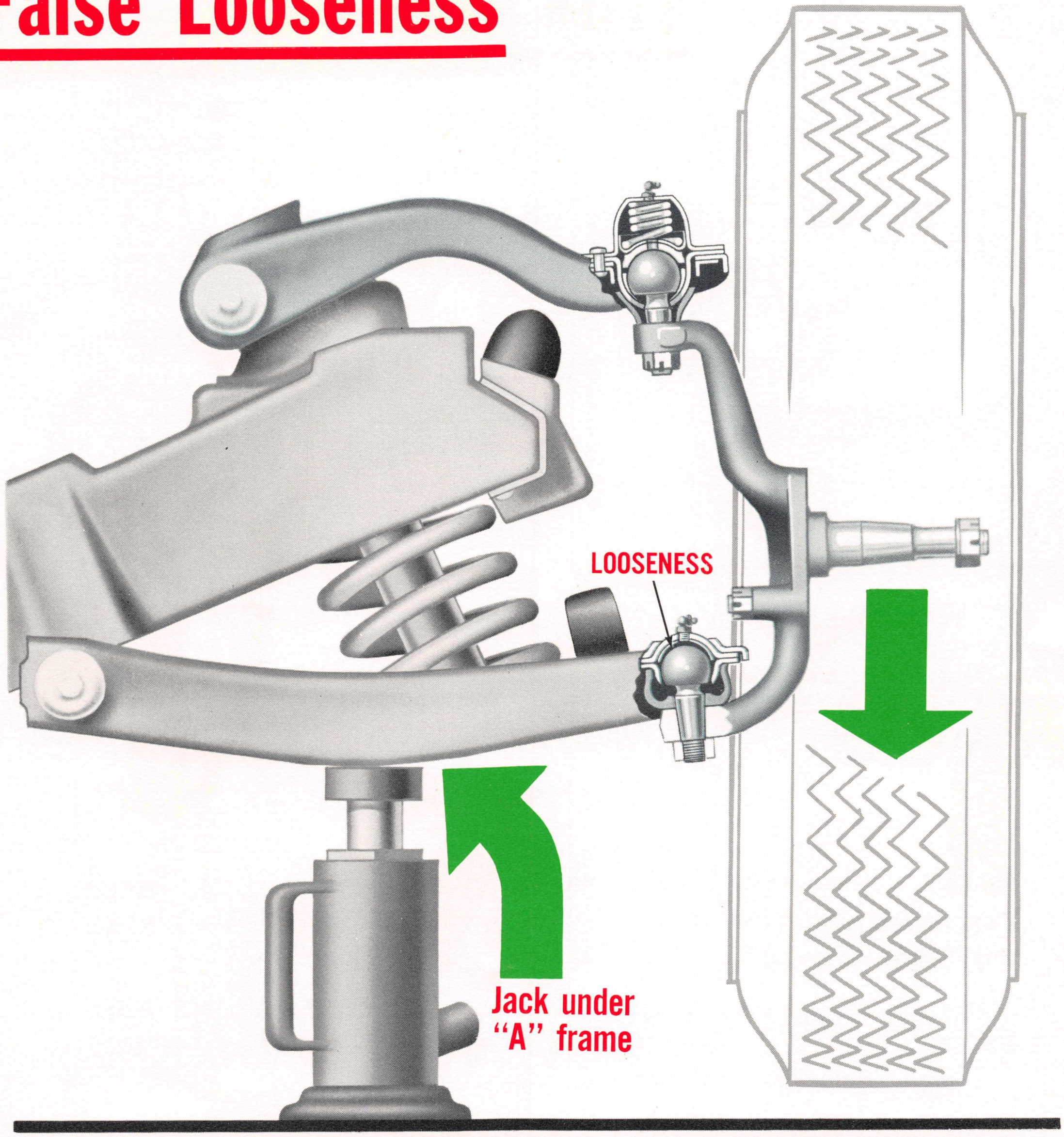
The original Lower or WEIGHT CARRYING Ball Joint was designed with a stud Pre-load Spring. This pre-load, together with the shape of the stud and socket parts, made it a self-adjusting unit (adjusts for wear). The difference between the loaded WEIGHT CARRYING Ball Joint and the "loose" WEIGHT CARRYING Ball Joint is the Pre-load Spring. The pre-load in the original WEIGHT CARRYING Joint forced the stud into its socket at all times. This prevented any looseness from being felt. However, on a car equipped with a "loose" WEIGHT CARRYING Joint, such is not the case.

True Wear vs.



With the jack under the CAR FRAME, the upper "A" frame, spindle and wheel assembly drops until it contacts the upper rubber frame bumper. The coil spring force keeps the lower "A" frame and ball joint socket tight against the ball stud. Note lines of force in same direction. Any wheel movement that can be felt with the assembly in this position is TRUE WEAR.

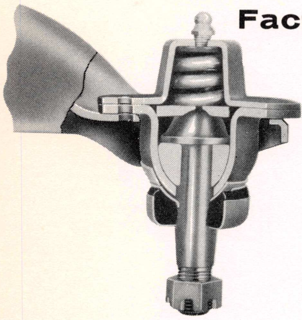
False Looseness



When the car is raised up under the LOWER "A" frame, the coil spring supports the weight of the car. The weight of the upper "A" frame, spindle and wheel assembly pulls the lower ball stud from its socket in the lower "A" frame. Note force arrows in opposite directions. When the stud is in this "unloaded" position, FALSE looseness can be felt. Sometimes new ball joints have this looseness . . . BUT NOT OURS!

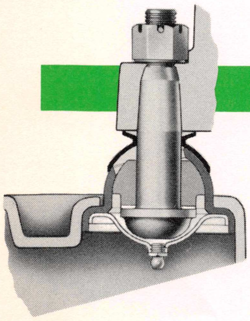
Upright Lower Stud Ball Joints

Factory Type ● (1957 Ford and Chrysler Products)



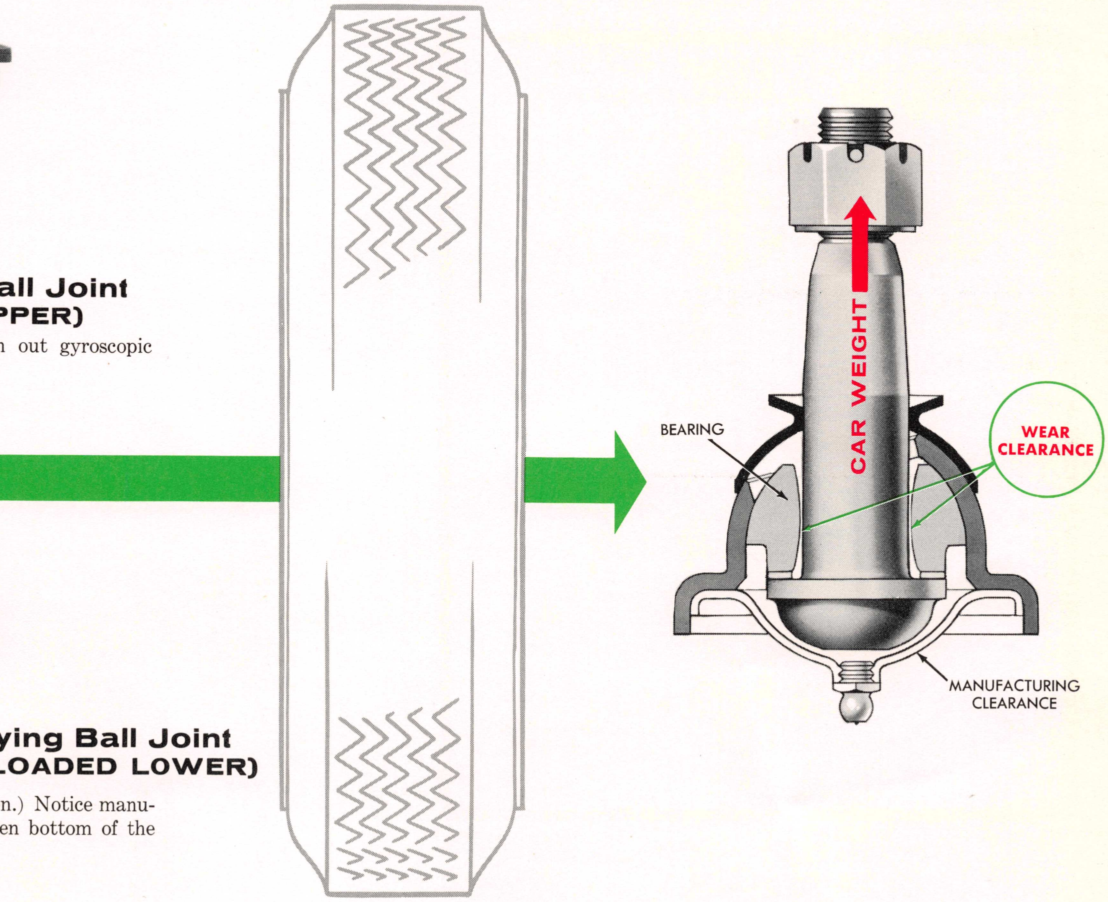
Dampening Ball Joint
(UPPER)

Spring loaded to dampen out gyroscopic action of the wheel.



Weight Carrying Ball Joint
(NON SPRING-LOADED LOWER)

(Stud in operating position.) Notice manufacturing clearance between bottom of the stud and cap.



In this original equipment production lower ball joint, the design of the housing and the shape of bearing outside diameter makes the joint self-adjusting for *part* of the wear that occurs.

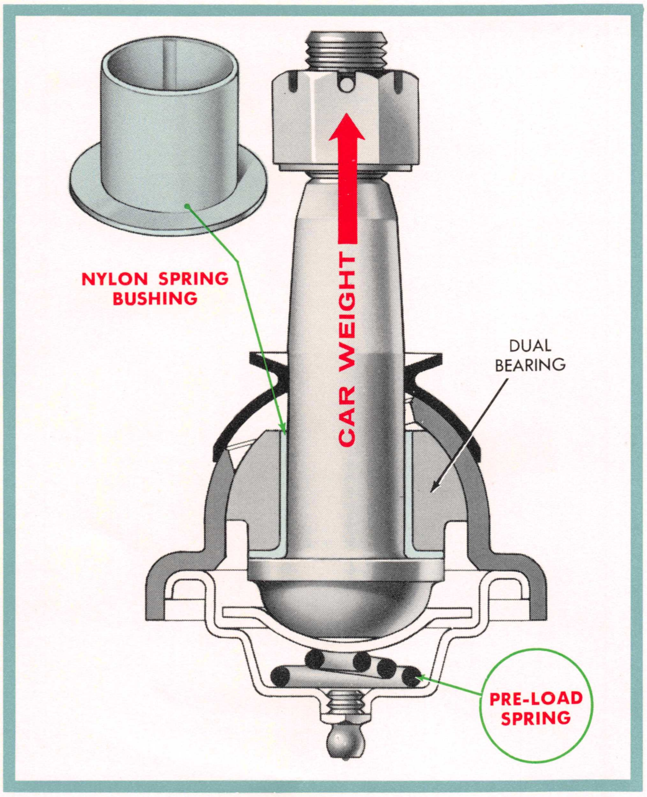
But . . . wear between the stud and bearing inside diameter is not compensated for. This wear allows side-to-side shifting of the stud . . . changes camber settings and causes tire wear.

The weight on each front wheel of 900 lbs. and more, is capable of keeping the stud seated under almost all conditions. However, there is a possibility that stud unseating and side-to-side stud movement can occur under certain wheel out-of-balance situations. For instance, where the control of the shock absorber and front spring are not adequate to keep the "A" frame and socket in contact with the stud. Unless the wear in the Joint has progressed beyond the self-adjustment take-up, it is *only* during the stud unseated time that wheel misalignment can occur with the UPRIGHT type Joint.

The shape of the socket and stud bearing outside diameter creates a self-adjusting condition for part of the normal wear that will occur in this type Joint. However, wear between the stud and the I.D. of the stud bearing is not self-compensating. This wear can be easily checked by jacking the car up under the *vehicle frame* (the ball stud will be seated) and trying to move the tire and wheel. Wear between the stud and bearing I.D. is the same as the wear between a king bolt and its bushing. Excessive clearance here means the Joint must be replaced.

Our Spring-Loaded Self-Adjusting Ball Joint

● Designed For The Replacement Industry



★ In our design the stud is spring pre-loaded in the direction of normal operation.

★ The nylon spring-bushing automatically adjusts for wear.

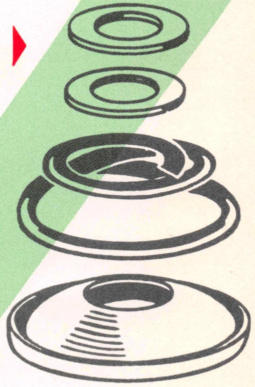
★ As a bearing, the nylon reduces wear between the stud and the dual bearing inside diameter. As a spring, compressed between the stud and the dual bearing inside diameter, it expands to compensate for wear.

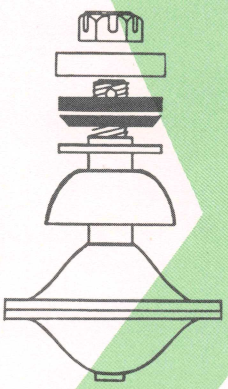
★ These Premium Features provide a completely self-adjusting ball joint that adjusts itself for wear in both vertical and horizontal directions.

REPAIR KITS

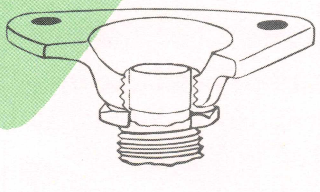
Ball joint repair kits may make the joint FEEL tight, but . . .

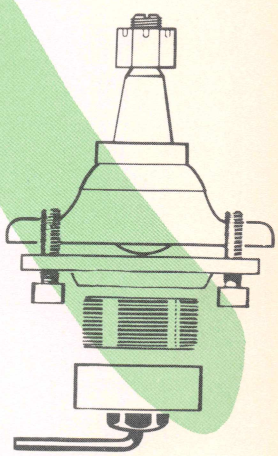
Does not compensate for wear between the bearing and stud. ▶





▲ The car weight overrides the small pre-load of the rubber insert. Does not compensate for wear between the bearing and stud.



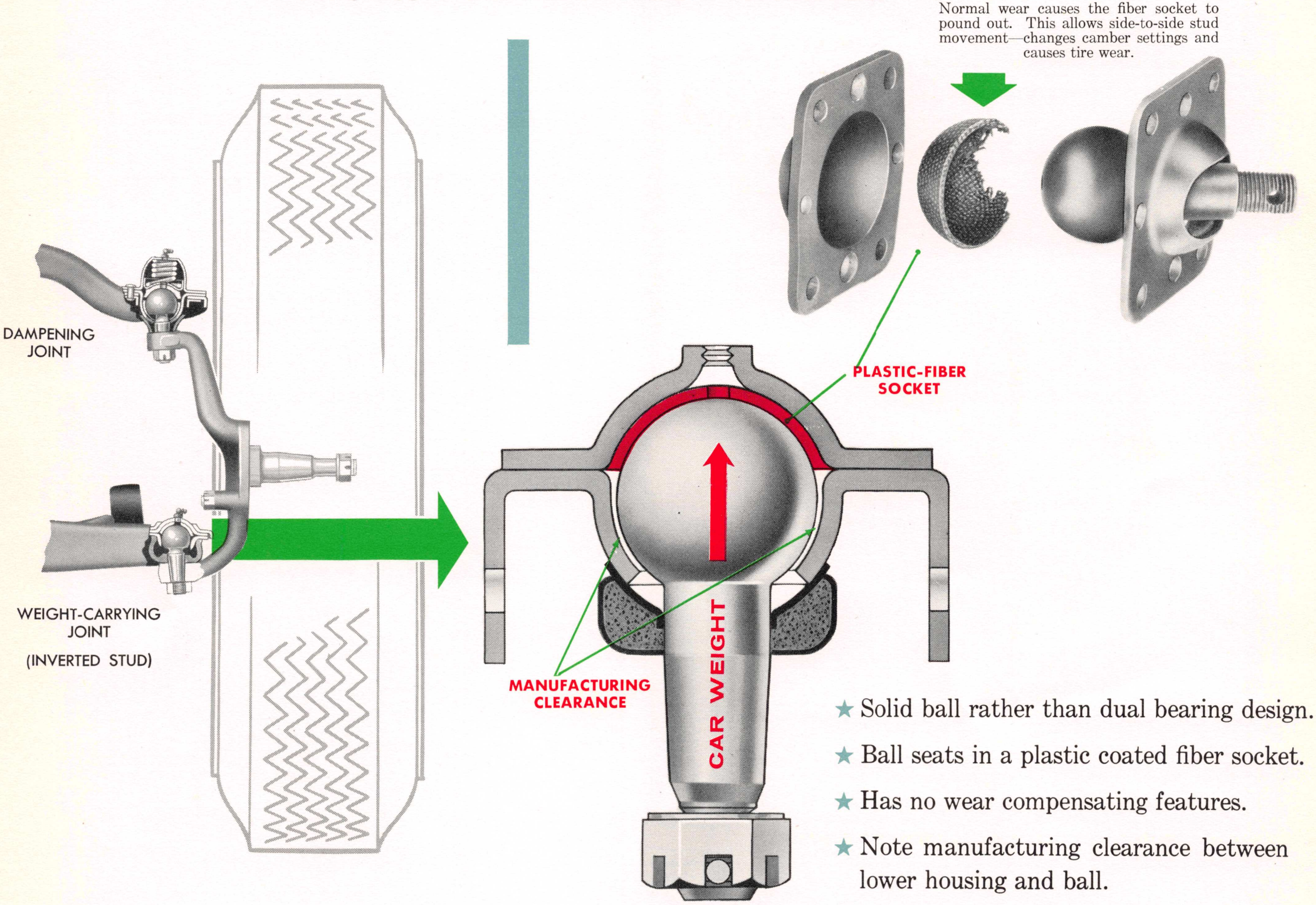


High Unit Cost . . . replaces no worn parts. Requires frequent *manual* adjustment. "Adjusts *nothing* but the mind."

Inverted Lower Stud Ball Joints

Factory Type ● (Chevrolet, Buick & Pontiac)

Normal wear causes the fiber socket to pound out. This allows side-to-side stud movement—changes camber settings and causes tire wear.

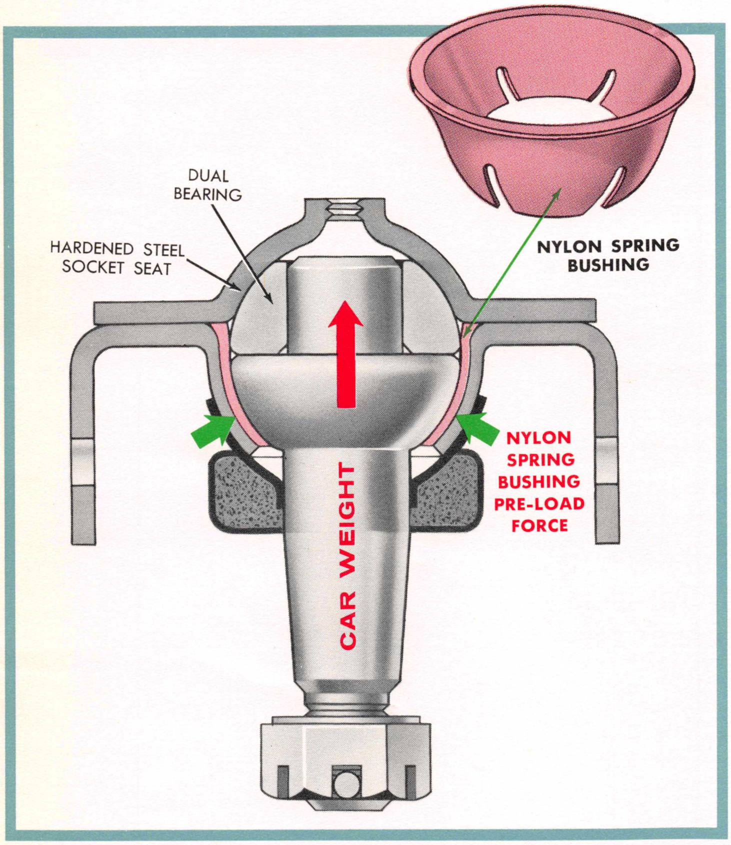


- ★ Solid ball rather than dual bearing design.
- ★ Ball seats in a plastic coated fiber socket.
- ★ Has no wear compensating features.
- ★ Note manufacturing clearance between lower housing and ball.

The 1955 Chevrolet (factory type) Lower Ball Joint is typical of the INVERTED stud WEIGHT CARRYING Joint. Buick, Pontiac and Cadillac also use the INVERTED stud design. The ball stud socket in the G.M. Ball Joint is made of plastic coated fabric. This ball stud and socket are somewhat self-compensating for wear. However, much of the wear that occurs is concentrated in the plastic socket at a point approximately 45 degrees from the top of the ball and toward the wheel. Note the position of the wear in plastic socket. As wear in the plastic socket progresses, it allows side clearance between the ball and the socket to a point where the Joint is no longer self-compensating. Because the resulting side-to-side stud movement occurs, EVEN with the weight of the car on the joint, wheel alignment cannot be maintained.

Our Spring-Loaded Self-Adjusting Ball Joint

● **Designed For The Replacement Industry**

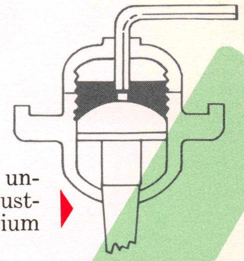

DUAL BEARING
HARDENED STEEL SOCKET SEAT
NYLON SPRING BUSHING
CAR WEIGHT
NYLON SPRING BUSHING PRE-LOAD FORCE

In our design we incorporate these premium features:

- ★ Dual-bearing construction
- ★ Nylon pre-load spring-bushing
- ★ Hardened steel socket seat
- ★ Metal-to-metal bearing surfaces
- ★ A ball joint that adjusts itself for wear in both vertical and horizontal directions.

REPAIR KITS

Ball joint repair kits may make the joint FEEL tight, but . . .

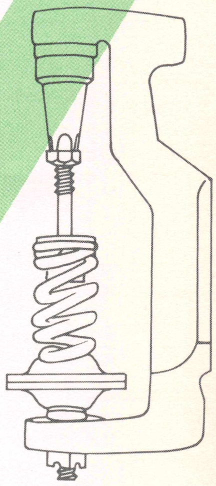


This type, not supplied by us, unfortunately needs frequent adjustment. . . and is sold at a premium price.

Pulls the stud out of the socket

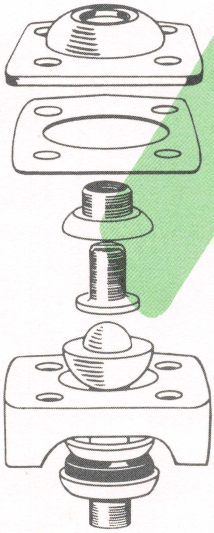
Does not repair the worn plastic socket in O.E. joint

Rubber insert is ineffective against car weight



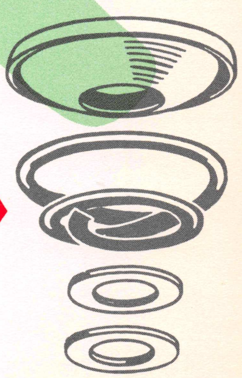
Does not repair the worn plastic socket

Joint will not hold camber adjustment



Premium priced complete joint . . . requires frequent manual adjustment.

Miniature size ball causes higher unit loading and more rapid wear rate on the parts.

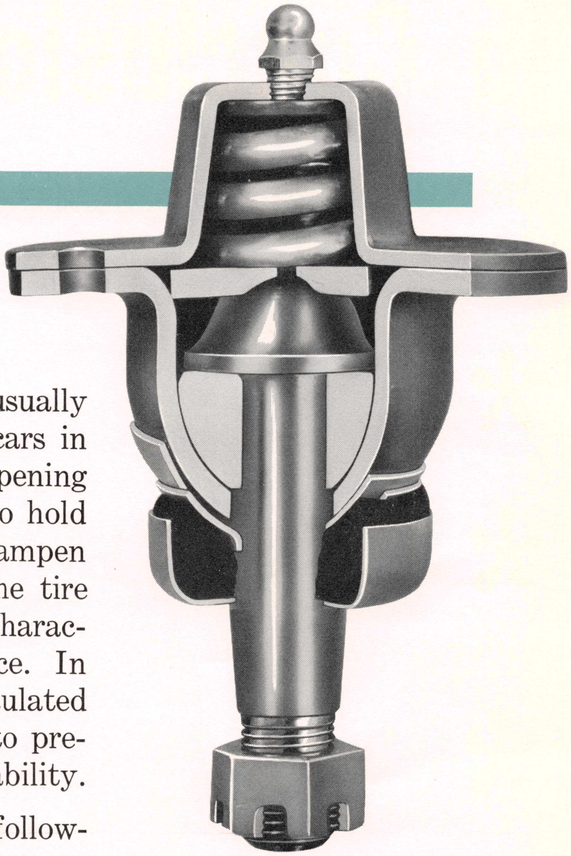


Pulls the stud out of the socket

Does not repair the worn plastic socket in O.E. joint

Small (wrong direction) pre-load spring is ineffective against car weight

The Pre-loaded Dampening Ball Joint



As stated earlier, the Dampening Ball Joint, usually the upper one, is basically the same on all cars in that each has the stud pre-loaded. The Dampening Joint carries no car weight. Its function is to hold one end of the spindle in position and help dampen out some of the gyroscopic movements of the tire and wheel assembly. Steering and handling characteristics are directly affected by its performance. In all cars, the Dampening Joint supplies a calculated amount of resistance to the steering system to prevent wander and increase the car's tracking ability.

The Dampening Joint can be checked by the following method:

1. Remove the stud nut and disengage stud from the spindle.
2. Install two nuts on the stud and lock together.
3. Apply a torque wrench to the nuts and test the turning resistance of the stud in the socket. (If exact vehicle manufacturer's specifications are not available, turning resistance should be approximately 2-8 ft. lbs.)
4. If the stud fails to meet these specifications either by too little or too much turning resistance, it must be replaced.

* If the dampening joint is worn out, it is an indication that the weight carrying joint needs replacing, too.

In Conclusion . . .

- Our ball joints are expressly engineered for the Replacement Industry.
- Our design is the ONLY correct and complete answer to the "loose" ball joint problem.
- All of our ball joints are spring-loaded and self-adjusting.
- Dual Bearing Designs . . . the principle used successfully for so many years in our tie rod ends.
- No manual adjustment needed!
- No gimmicks, No falsies!
- The *best* ball joints in the industry—from the people who developed the original ball joint suspension and improved upon it for Replacement use.

The complete engine
chassis and
automatic transmission
parts line...

TOLEDO STEEL PRODUCTS

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